

A Novel Approach towards Automation of Agricultural Work by using Artificial Intelligence and Robotics

Sakshi Sahu ¹, Pranita Wath ², Shashwat Vairale ³, Pratik Ladikar ⁴

Students, Department of Computer Science and Engineering, Prof Ram Meghe Institute of Technology and Research, Amravati, Maharashtra, India^{1,2,3,4}

ABSTRACT: Sowing machine should be capable of sowing different kind of crops, it should be reliable, and this is the basic requirement of using sowing machine. Thus there is a need to make sowing machine which operates automatically thus increasing the efficiency of planting also reduces the issues encounters in manual planting. Seed sowing machine should plant different types and different size of seeds by maintaining the proper distance according to the type of seed. Today world is moving towards the rapid growth in all sectors including the agricultural sector. So, farmers must improve their techniques used for sowing the seeds. The main concern regarding a human labor is his/her reliability. Plenty of scenarios could result in the human labor not working properly. This problem can definitely be solved by the robot. For this project we will use E-Yantra robot. E-Yantra is the robotic platform, which has been designed and developed by the IIT, Bombay for learning as well as, for the purpose of education. The main component used by means of the e-yantra robot is AVR Atmega 2560 micro controller that supervises and controls the entire process.

KEYWORDS: sowing, automatically, E-yantra, farmers, space

I. INTRODUCTION

Agriculture is the back bone of our economy. About two third of our population depends on farming. Today it has become necessary to increase the agricultural productivity of India, to satisfy the increasing demand of the ever increasing population. Seed is the basic and most crucial input for sustainable agriculture. Seed sowing is significant and tedious activity for any farmer, and for large scale this activity requires more workers. In manual method of Seed planting, we get results such as low seed placement, less spacing efficiencies, wastage of seeds and serious back ache for the farmer. This also limited the dimensions of field which will be planted. Hence for achieving best performance the above limits should be optimized. Thus to make proper the agricultural bot selection of the components is required to suit the requirements of crops.

Seeds will be sown automatically by using E-yantra robot so human efforts will be reduce. The E-yantra robot is the robotic platform developed by IIT Bombay such that various applications are performed in the e-yantra module. E-yantra module consists of three types:

- Configuration-1: Master: P89v51RD2 Slave: ATmega2560
- Configuration-2: Master: ATmega 2560 Slave: ATmega8
- Configuration-3: Master: LPC 2148 Slave: 2 x ATmega8

Among which this project will work on ATmega 2560. This process is totally automated so that the farmers will need not to visit the farm for work. This process is automated as well as it does not cause any greenhouse gases on earth. This technology is safe.

II. PROBLEM STATEMENT

To build a robot, that automates the whole seed sowing operation using Firebird. The drawbacks of manual seed sowing are:

- Increased time consumption.
- Decline within the rate of production.
- Wastage of precious seeds.
- No uniformity within the distribution of seed placement.

- No proper germination of seeds.

Thus the essential remedy for this is often the automation of the seed sowing process, and thus building an autonomous seed sowing robot is the primary and most vital step in automation of this process.

III. LITERATURE REVIEW

In [1] authors intended on building machine which operates manually and easily affordable by the farmers. This machine is capable of sowing different types of seeds and limitations of single seed sower were eliminated. This manually operated seed planter machine requires manpower for its operation. In [2] Design and Fabrication of Seed Sowing Machine captures solar power then it's converted into electricity which is employed to charge battery, which then gives the required power to a shunt wound DC motor. Ultrasonic Sensor and Digital Compass Sensor are used with the assistance of Wi-Fi interface operated on Android Application robot within the field. This brings down labor dependency. Seed sowing and digging robot will advance various ground contours and performs digging, sowing the seed and covers the bottom by closing it. In [3] focused on the seed sowing, fertilizer in rows at desired depth and seed to seed spacing, cover the seeds with soil and supply proper compaction over the seed. Disadvantages of this machine are it requires more effort in hard soil, Operating force varies according to the person and it's operated manually. In [4] paper deals with the various methods used in India for seed sowing and fertilizer placement. It proposed new machine that can perform simultaneous operations and its working is compared with traditional method of sowing seeds.

IV. PROPOSED METHODOLOGY

The robotic system plays a major role in all sections of societies, organization and industrial units. In this proposed model, automated robot is simple in construction and employed to reduce the human effort and saves times in farming operations. It has a programmed control towards all directions in the field.

Our mechanism consists of three sections:

A. Seed Storage Unit:

The storage unit is used to store the seeds required for sowing. It is stationary. Seeds are poured into In the seed funnel.

B. Temporary seed separation unit:

This unit will be used for temporary storage of one seed and is then feed into dispensing. This process will continue to drop one seed at a time. Thus, this mechanism will not allow more than one seed at the same time. preventing any unwanted loss of seed. At the bottom of the seed funnel, servo motor is fixed that helps in opening and closing of the funnel with a certain period of interval. The seeds spacing is mainly based on the programming of the microcontroller.

C. Dispensing unit:

After the seed comes in this unit, it directs to the respective hole either left or right direction. After all of this the seeds dropped in the hole and the robot moves ahead.

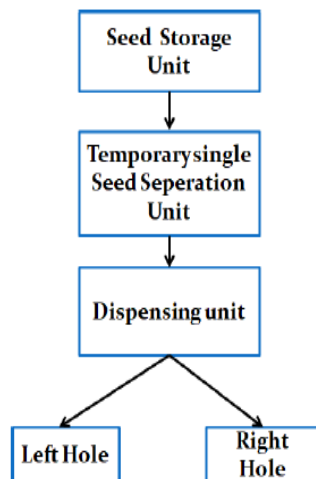


Fig 1. Proposed System

V. ARENA

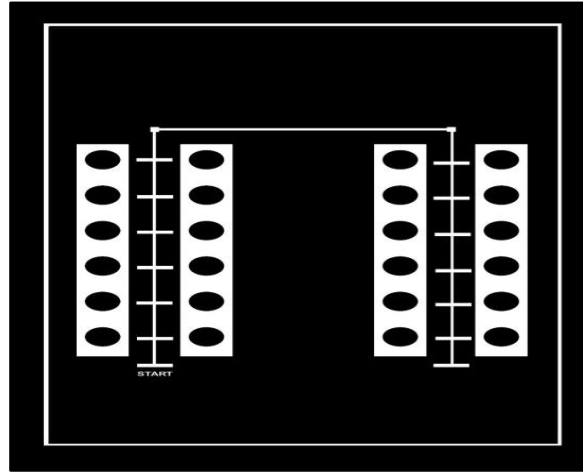


Fig 2. Arena

VI. HARDWARE REQUIREMENT

A. Firebird V

Firebird v is the robot which is developed by the IIT, Bombay for education reason. It is the advanced robotic platform having number of functions already built in it. In addition there is provision in the structure so that one can interface the external hardware on it for different application. We will use this robot to perform main task.



Fig 3. Firebird V Robot

B. L293D

ICL293D is a Motor Driver IC is embedded on firebird. DC motor direction can be change by applying different inputs on this IC. L293D IC is a16 pin IC. It is possible to control speed and direction. Two DC motors can be run simultaneously with the same IC.

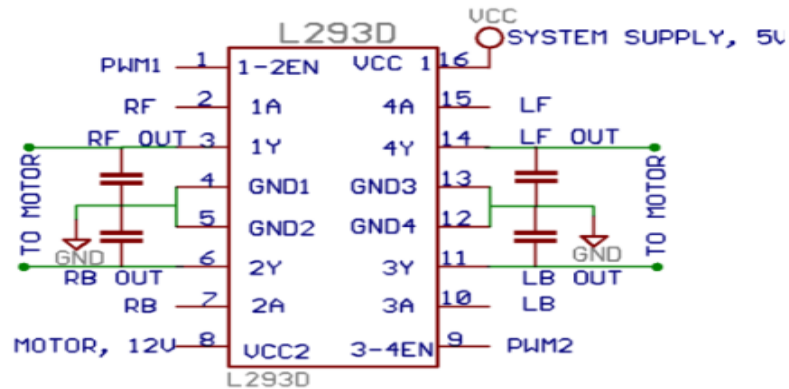


Fig 4. L293D

C. Sensors

Line sensors: Helps the robot move across the arena along the line. The three line sensor gives different reading on black and white surface as white reflects the entire light incident on it while black absorbs the light incident. A program can be written which will guide the robot to move based on the values of sensors.

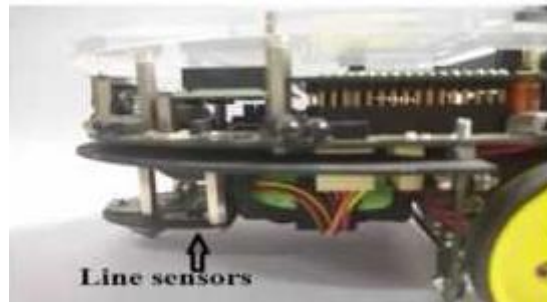


Fig 5. Line Sensors

D. Actuators

A seed sowing robot requires the following list of actuators for its specified task

- Servo motor (0-180° rotation): Required within the mechanism for rotation by particular angle for dropping required number of seeds in the hole. It is connected to PORTB of ATMEGA2560 microcontroller.



Fig 6. Servo Motor

- DC motors: It is required for motion of the robot along the arena. The line sensor reading controls the motion DC motors. They are powered by internal “v mot” supply, a L293D IC is a motor driver IC which controls the speed and motion of the bot.

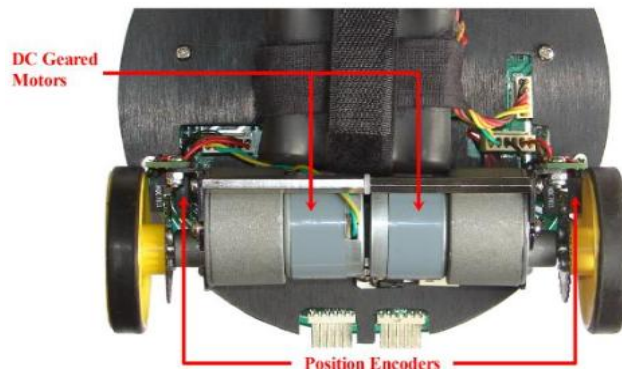
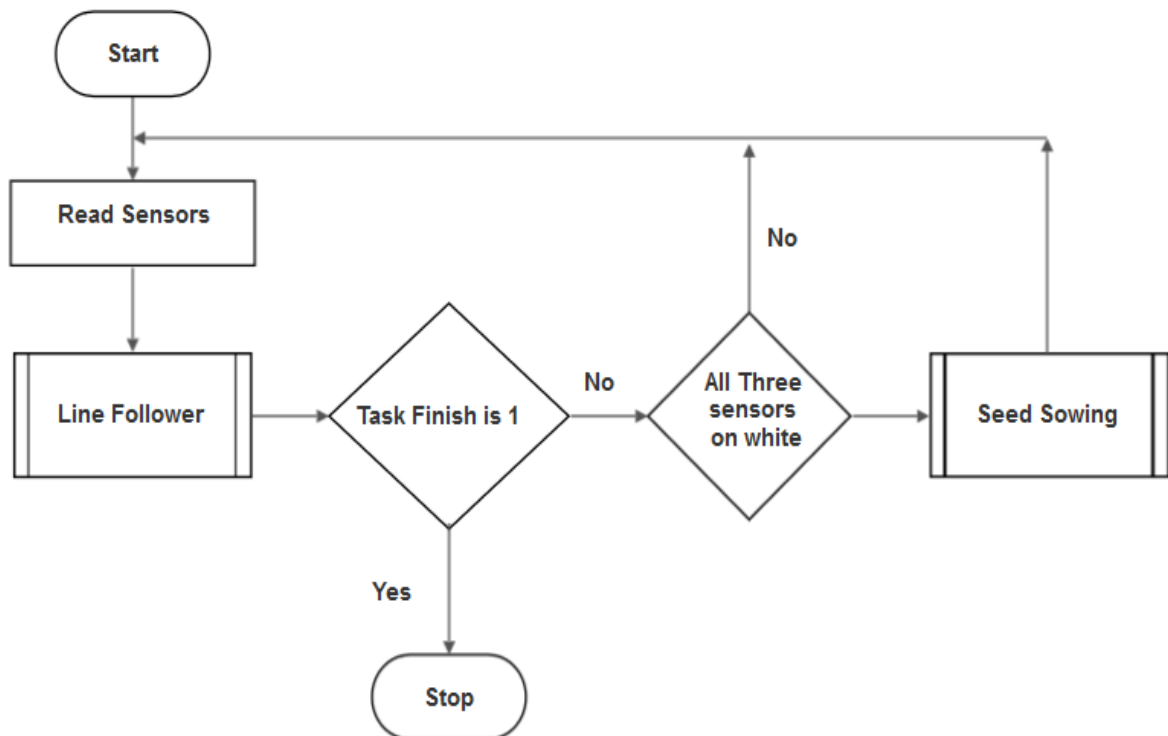


Fig 7.DC Motors

VII. ALGORITHM ANALYSIS

A. Main program

Program starts with reading sensors because line following function is depend on the sensor value. Robot will continue to follow line until it finishes seed sowing function. Here, white is used to indicate the colour of surface. If all three sensors present at the bottom of the bot are on white then and then only sow seeds and move forward.



B. Line follower function

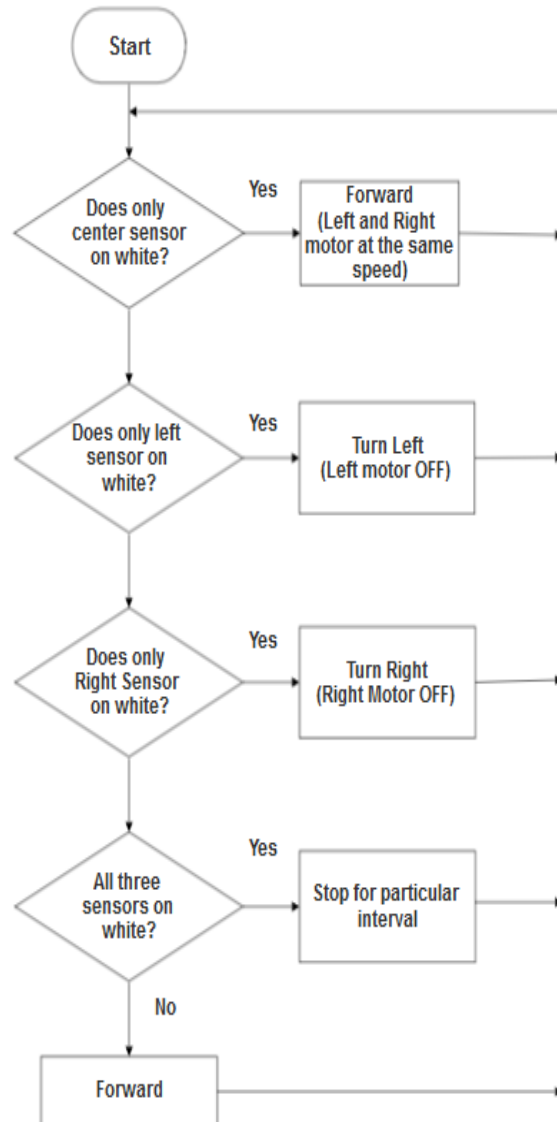
In the line follower algorithm below the sensors are represented by the terms left, right and centre respectively .while black and white terms are used to indicate the colour of the surface.

Case 1: If only the centre sensor detects a white line, then the robot must moveforwardto follow the line.

Case 2: If only the left sensor detects a white line, then the robot must steerleftto follow the line.

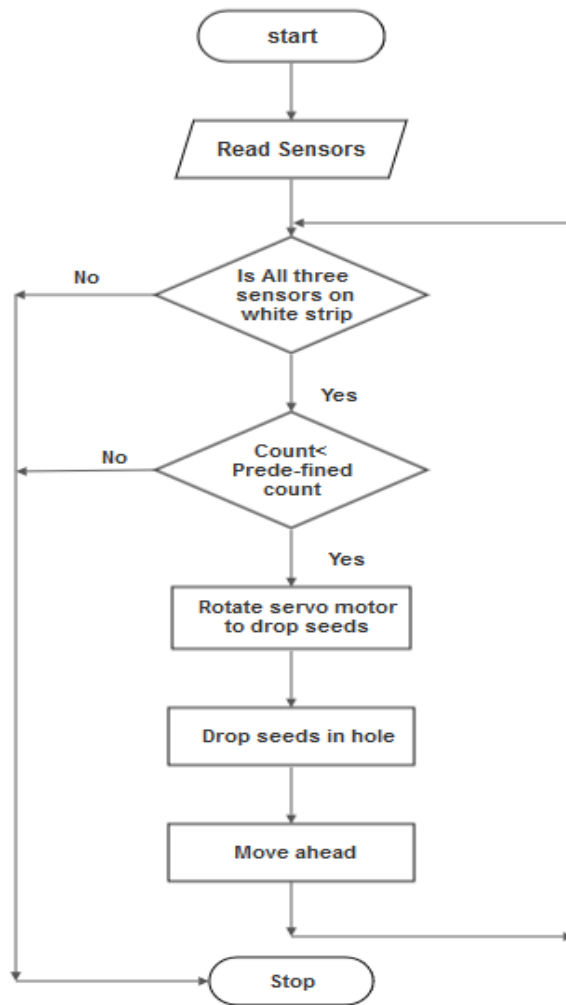
Case 3: If only the Right sensor detects a White line, then the robot must steer right to follow the line.

Case 4: If centre, left, and right sensor on white then stop for particular time because in this time period seed sowing function will get performed.



C. Seed sowing function

Seed Sowing Function is performed when all three line sensors are on white surface. Here we are using counter to count the number of hole predefined by the user. If counter is less than predefined count value then stop bot for particular time period then rotate servo motor so that seeds will get dispensed in both left and right hole. After that, move robot forward until counter becomes greater than count.



VIII. RESULT AND DISCUSSION

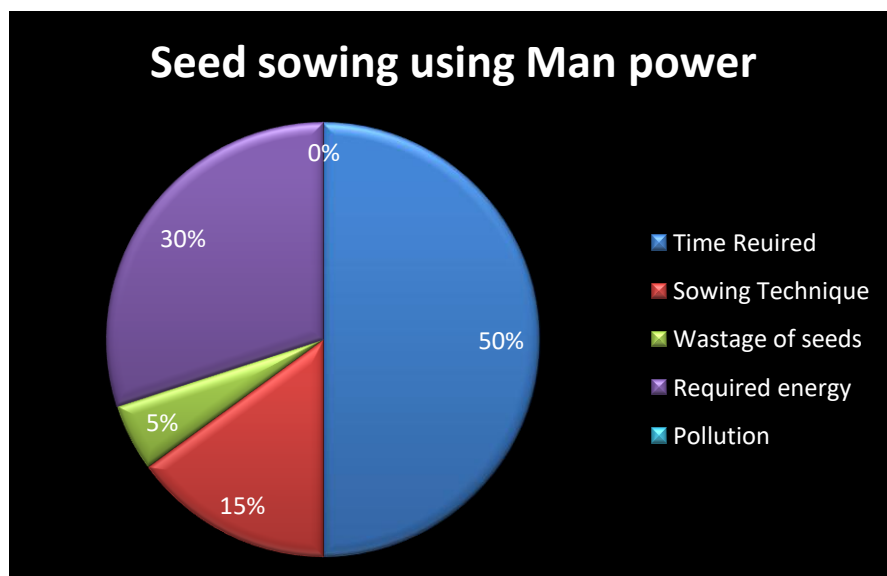


Fig 8.Pie chart of seed sowing using manpower

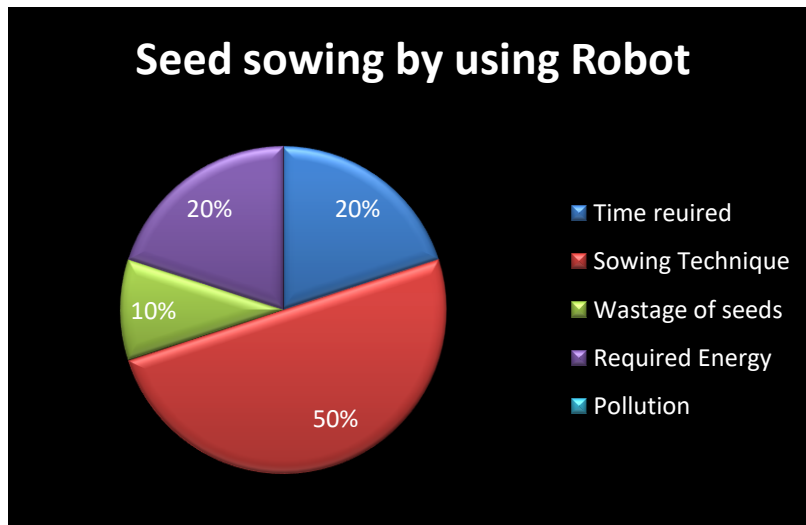


Fig 9. Pie chart of seed sowing bot

The seed sowing bot is a one-time investment asset. It will save a lot of money which were to be used by human labour. This robot will be highly reliable for its work/task. The main concern regarding a human labour is his/her reliability. Plenty of scenarios could result in the human labour not working properly. This problem is definitely solved by the robot.

IX. CONCLUSION AND FUTURE WORK

This seed sowing bot will have great potential for increasing the productivity of the planting. This method will reduce the labour requirement. By using this process wastage of seeds will reduce to a greater extent. The mode of operation will be very simple even to the layman. It will be more efficient than the present existing machines of this category and range. By using this robot we will get accuracy in seeding.

In future System can be fully automated, by providing user interface where the user will have to enter the number of troughs, crop type, distance between the seeds and time to sow and the bot moves to particular locations based on schedules. Inter-seeding distance can be dynamically changed based on the crop chosen by the user.

REFERENCES

- [1] R. Kyada & D. B Patel, DEC 2014 "Design And Development Of Manually Operated Seed Planter Machine" of Lecture 5th International & 26th All India Manufacturing Technology, Design and Research Conference (AIMTDR 2014), IIT Guwahati, Assam, India. Vol 2.
- [2] Thorat Swapnil V, Madhu L Kasturi, Patil Girish V, Patil Rajkumar N, 'Design and Fabrication of Seed Sowing Machine', International Research Journal of Engineering and Technology (IRJET), Volume: 04, Issue: 09 Sep - 2017.
- [3] Prof. Swapnil Umale, Mr. Ashish Tayade, Mr. Santosh Deshmukh, Mr. Mangesh Deokar, Mr. Pramod Umale "Multi Seed Sowing Machine", International Journal of Advance Engineering and Research Development A National Conference On Spectrum Of Opportunities In Science & Engineering Technology, Volume 5, Special Issue 06, April-2018 (UGC Approved).
- [4] A. Keerthana, P. Kirubakaran, S. Krishnamoorthy, K. Rajeswari, Mr. G. Syed Zabiullah 'Agriculture Robot for Seeding and Forming', International Research Journal of Engineering and Technology (IRJET), Volume: 05, Issue: 05.
- [5] Prof. Reetesh V. Golhar, Pranali M. Bakre, 'Automatic Seed Plantation Robot with e-yantra and IOT', © 2018 IJIRSET Volume 4, Issue 7 Print ISSN: 2395-1990 Online ISSN: 2394-4099, Themed Section: Engineering and Technology
- [6] Sateesh Mudalagi, Mahantesh Tanodi, Sujata Huddar, 'Automated Solar Powered Seed Sowing Machine' Journal of Advances in Science and Technology, Vol. 12, Issue No. 25, (Special Issue) December-2016, ISSN 2230-9659.
- [7] Suraj V Upadhyaya, Vijaya Vittala Gowda G, Poojith M B, Vikranth Kumar K, 'A Review on Agricultural Seed Sowing' International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization), Vol. 6, Issue 4, April 2017.
- [8] FireBird VI Hardware Documentation. IIT Bombay & NEX Robotics Pvt. Ltd.
- [9] FireBird VI Software Documentation. IIT Bombay & NEX Robotics Pvt. Ltd.